Modeling Waves in the Electromagnetic Spectrum

In this activity you will use a metal spring-coiled toy to model electromagnetic radiation and measure the properties of the wave you create.

Objectives:

- Model waves in the electromagnetic spectrum.
- Classify types of electromagnetic energy by wavelength.
- Demonstrate the relationship between wavelength, frequency, and energy.

Research Question:

What kind of radiation strikes the surface of the Moon? How is it different from what is found on the surface of the Earth?

Discussion Questions:

- What happens to wavelength if you increase the frequency of the waves?
- How does the amount of energy in continuously generated high-frequency waves compare to low-frequency waves?

Materials

A metal spring-coiled toy, meter stick, stopwatch

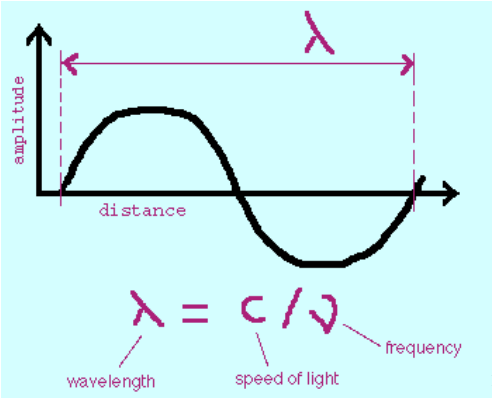
Directions:

1. Stretch the metal spring-coiled toy out over several meters between two people on a smooth, open floor.

2. Wave one end of the coil side to side to produce transverse waves that ripple toward the other person. Note: if the spring-coiled toy is stretched very tight, the wave will reflect back to the source and will alter the speed of the wave; make sure you are producing waves that are uniform and alike

3. Measure and record the amount of time it takes one wave to travel from one person to the next and the distance between the two people. Use this information to calculate frequency in waves per second and the velocity of the wave. Use the diagram and formulas to help in your calculations.

4. Calculate wavelength and energy. After completing this for a wave of one frequency, alter the wavelength or frequency and make more calculations to observe how waves of different wavelengths or frequencies behave. Use the diagram and formulas to help in your calculations.



[1]

For electromagnetic waves:

$$\lambda = c / \nu$$

Wavelength (λ) [pronounced lambda] equals the speed of light (c) divided by the frequency (ν) [pronounced nu]

$$E = h \times \nu$$

Energy equals Planck's constant* (h) times the frequency

*Approximately 6.625×10^{-27}

For the waves generated with the metal spring-coiled toy:

$$V = \lambda \times f$$

Speed of the wave equals wavelength times the frequency of the wave

[1] http://imagine.gsfc.nasa.gov/docs/science/know_l2/emspectrum.html